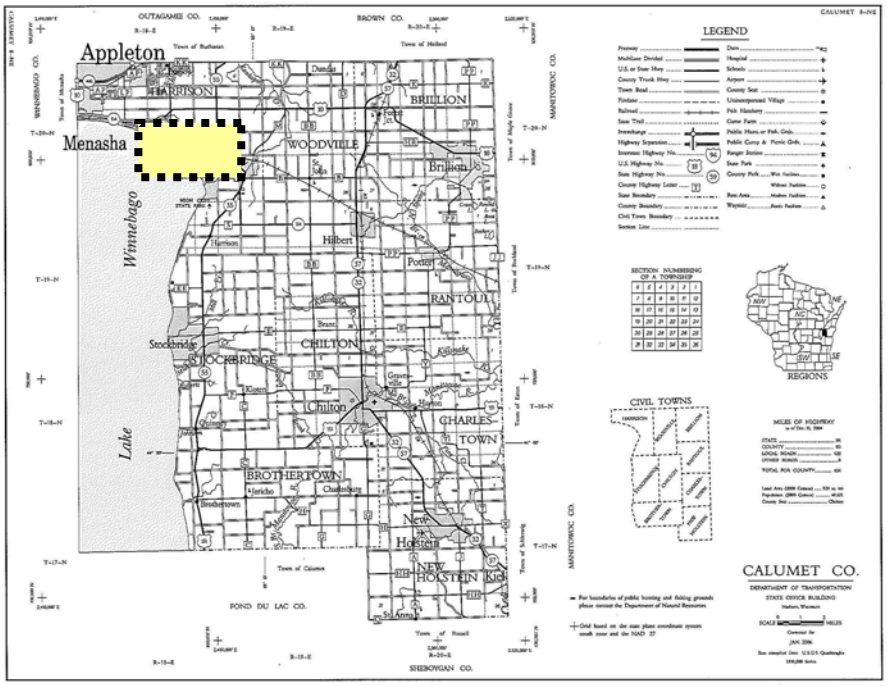
Traffic engineering safety and speed study

WIS 114
US 10 - Sherwood
Calumet County

WisDOT NE Region
August 2006



Background: In May and June 2006, citizens living along this segment of WIS 114 made a request to the County Highway Committee and the Wisconsin Department of Transportation (WisDOT) to have the speed limit reduced from US 10 to the village of Sherwood. The department agreed to perform an engineering study to determine if such a change was feasible and justifiable. The following report summarized the results of the engineering study for the highway between US 10 and Sherwood.

Description: Figure 1 shows the segment study area. Following the split with US 10, WIS 114 proceeds southeast approximately 2.5 miles before running concurrently with WIS 55 through Sherwood. WIS 114 then departs from WIS 55. WIS 55 continues southerly to Stockbridge and WIS 114 easterly toward Hilbert. For the purposes of this report, the highway will be referred to as WIS 114.
Existing WIS 114 along the study segment is a two lane rural highway with 12-foot travel lanes and 8-foot shoulders, 3 feet of which are paved. The posted speed is 55 miles per hour (mph).

WIS 114 immediately west of the study segment runs concurrently with US 10 from the city of Menasha (Oneida Street) approximately 3.5 miles easterly to a system interchange where WIS 114 splits off southeast toward Sherwood. The 3.5-mile segment is a 4-lane divided highway with at grade intersections. The only exception is the system interchange used to split the two highways. The posted speed limit is also 55 mph.

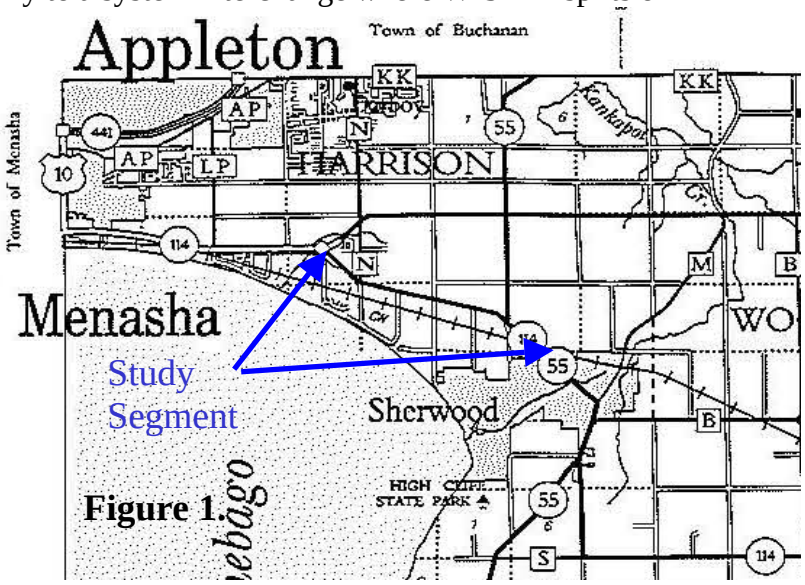


Figure 1

WIS 114 immediately east of the study segment enters Sherwood. WIS 114 transitions from a 2-lane rural highway to a 2-lane urban highway with two travel lanes and parking lanes with curb and gutter. The speed limit drops to 45 mph on the west entrance to the village (rural cross section), then to 30 mph through the more developed central part of the village (urban cross section with curb and gutter) and then increases to 45 mph (rural cross section) and then 55 mph as it exits the south side of the community.

Sherwood is a rural community bordering the northeast corner of Lake Winnebago. High Cliff State Park is an integral part of the village, bordering its southwest and south sides. The village affords its residents an easy commute to the Fox Cities. Fast growth exists on the village's west end and projected growth is expected on the north side as well.

Traffic: Figure 2 shows the Annual Average Daily Traffic (AADT) taken from the WisDOT Highway Traffic Volume Data from 2000. Traffic volumes increase from west to east or from US 10 to Sherwood. Traffic is continually drawn to or taken from the highway to other regional centers. WIS 55 to the north leads to and from Kaukauna. Hwy N leads to and from the Darboy/Little Chute/Kimberly/ Combined Locks area. These north/south roadways also provide alternate routes to WIS 441, a regional 4-lane freeway that completes a freeway loop around the Fox Cities with US 41.

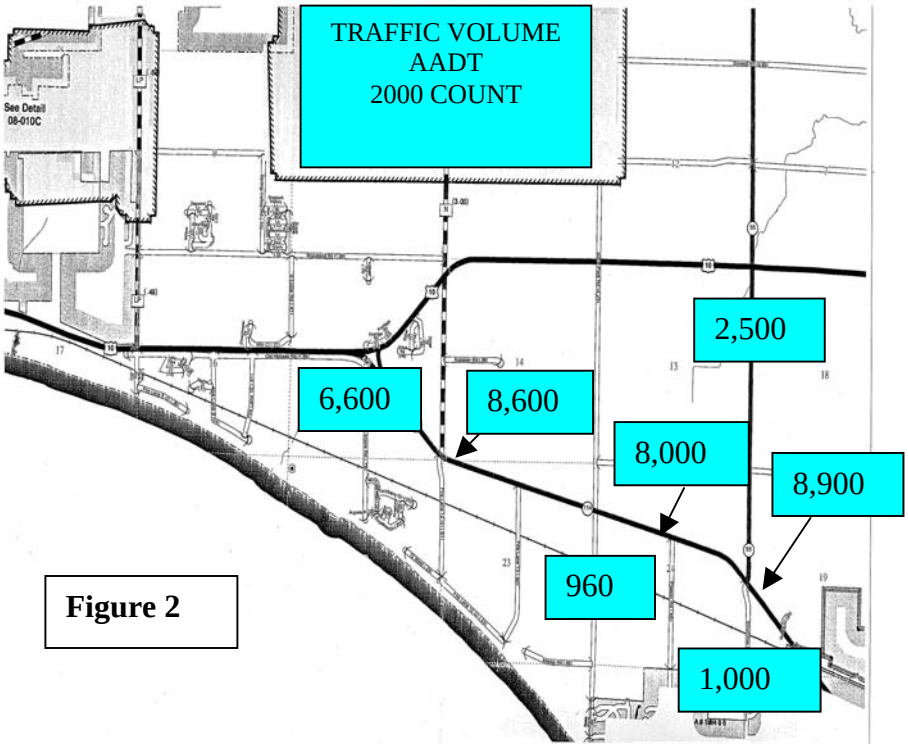


Figure 2

Figure 3 shows the AADT data from 2004. Also provided is the average annual growth in traffic found on these highways. The growth data may be somewhat misleading in that the growth may have been higher in recent years (2003/2004) as compared to the average over the four-year period. Average traffic growth was used to compute crash rates for this study. This will result in conservative computations for recent crash rates.

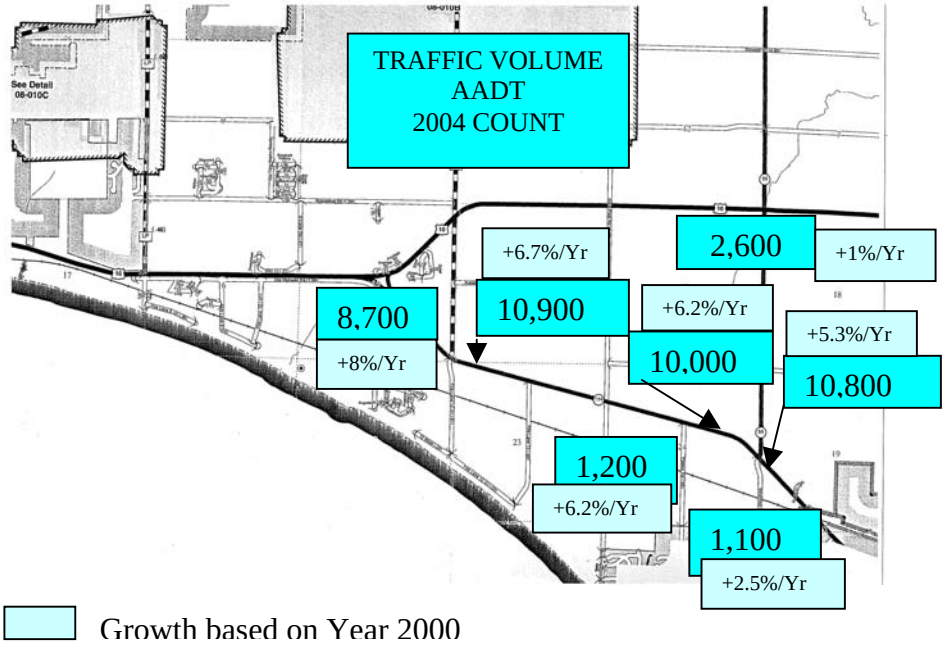


Figure 3

WIS 114 crash summary:

Five years of crash data were retrieved for review. Figure 4 is a spot map showing approximate locations of the crashes and severity. The exact locations and descriptions require the review of the actual crash reports. In the timeframe for preparation of this report, the copies could not be obtained.

The department uses a crash rate to assess the significance of problems experienced on a given segment of highway compared to other similar highways on the state highway network. The rate is given as follows:

WIS 114 Crash Map
US 10 to Sherwood
Calumet County

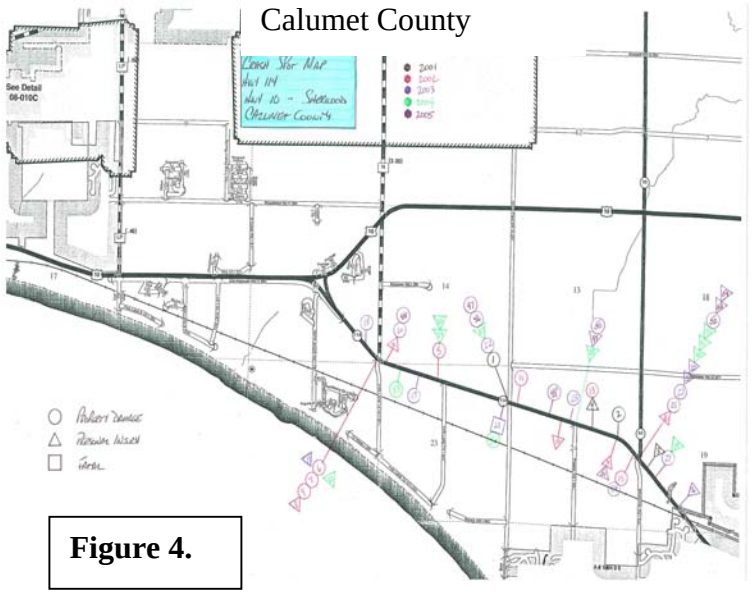


Figure 4.

Crash Rate = $\frac{[(\text{\# of crashes})*100{,}000{,}000]}{[(\text{Segment length in miles})*AADT*365}$

Rate expressed as crashes per 100 million vehicle miles traveled

In order to compute the crash rate for this segment of highway, the AADT had to be computed for input into the formula. Since the AADT varies from west to east, a weighted average was computed. The procedure used can be found in the appendix to this report. The segment length was estimated to be 3.5 miles. Figure 5 is a summary of the crash rate for this segment of WIS 114. A comparison between the crash rate on WIS 114 and the statewide crash rate for rural highways indicates that the crash experience is low on this particular segment. That doesn't mean there aren't specific issues or problems that could be addressed. It merely means that there are many other highways with higher crash experience.

WIS 114 Crash Rate

Rate = (Crashes per year)*100,000,000/[ADT*365*Length in miles]
Statewide rate for rural stat highways varied from 104 – 121 from '01-'05

- Crashes — Excludes deer crashes
  - 2001 – 4
  - 2002 – 12
  - 2003 – 14
  - 2004 – 11
  - 2005 - 10
- Rate
  - 2001 = 35 Crashes per 100 Million Vehicle Miles Traveled
  - 2002 = 98 Crashes per 100 Million Vehicle Miles Traveled
  - 2003 = 109 Crashes per 100 Million Vehicle Miles Traveled
  - 2004 = 82 Crashes per 100 Million Vehicle Miles Traveled
  - 2005 = 71 Crashes per 100 Million Vehicle Miles Traveled

Figure 5.

The intersection of WIS 114 and WIS 55/Stommel Road experienced a number of crashes during the study period. An examination of these crashes also revealed a relatively low crash rate. The formula used to compute the intersection crash rate is given as follows:

$$\text{Intersection crash rate} = \frac{[(\#\text{ of crashes})*1{,}000{,}000]}{[(\#\text{ of vehicles entering daily})*365]}$$

Rate expressed as crashes per million entering vehicles

The procedure used to compute the crash rate for this intersection is shown in the appendix to this report. Figure 6 summarizes these findings. Typically, rates above 1.5 crashes per million entering vehicles indicate there may be a problem. Intersections with crash rates above 2.0 are considered to have poor safety performance. Again, the rate doesn't mean there aren't problems that could be addressed; it is merely a means of making a quantitative assessment of the intersection's safety performance as compared to other similar intersections. The results indicate a relatively low crash experience as compared to other similar intersections. The department does plan, however, to construct a roundabout at this location in the near future. Sherwood is approximately one mile east of this intersection. The roundabout will not only reduce crash experience at this intersection, it should also calm highway traffic speeds before entering Sherwood.

WIS 114 and WIS 55/Stommel Road

Intersection crash rate = Crashes per million entering vehicles
Rate = (# of crashes)*1,000,000/[Entering traffic*365]

- Crash Rate
  - 2001; 0.0 Crashes per million entering vehicles
  - 2002; 0.24 Crashes per million entering vehicles
  - 2003; 0.93 Crashes per million entering vehicles
  - 2004; 0.67 Crashes per million entering vehicles
  - 2005; 0.64 Crashes per million entering vehicles

Figure 6.

Speed profile: The department worked with the Calumet County Sheriff's Department to collect speed data on WIS 114. The department utilized an automated recording system at three locations. One was placed several hundred feet east of State Park Road. Another was placed several hundred feet east of Pigeon Road. The other was placed several hundred feet west of WIS 55/Stommel Road. The Calumet County Sheriff's Department placed a speed board at the Pigeon Road location to provide feedback to the driver as to their travel speed. The State Park Road site was used to define the speed profile for WIS 114 because it was the site that encountered the least interference from intersections. The WIS 55 site was impacted by the proximity of the data collection to WIS 55.

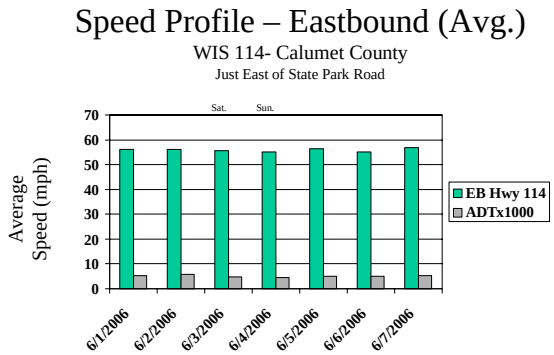


Figure 7.

The Pigeon Road site might have been impacted by the presence of the speed board. An engineering evaluation of highway speeds must eliminate these factors. Figure 7 and Figure 8 show the **Average Speed** of WIS 114 traffic at the State Park Road site for eastbound and westbound traffic. A summary of all the speed data is provided in the appendix to this report. Figures 9 and 10 show the **85th Percentile Speeds** at the same site. The posted speed should be between these two values. A true engineering speed study would only measure the speed of free flow vehicles. Free flow vehicles are those that are not under any influence other than the roadway. A free flow vehicle will not be following other vehicles, slowing to turn, delivering mail, etc. The data collected for this study measured the speed of all vehicles. If only free flow speeds had been collected, the average and 85th percentile speeds would be somewhat higher.

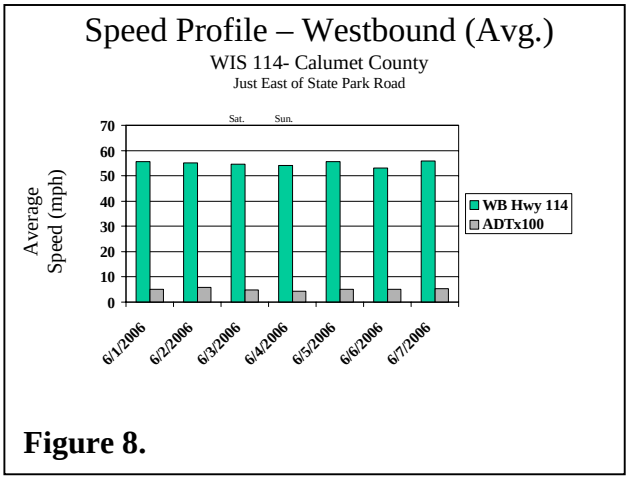


Figure 8.

There are other factors that are considered when establishing a speed limit for a roadway in addition to the speed profile. The adjacent development along the highway plays a large role in creating the environment that affects the driver's behavior relating to speed. Curb and gutter, close building spacing, and frequent driveways are among the factors that have a dramatic natural affect on reducing speed. This study segment does not contain these characteristics. Adjacent land use is primarily agricultural with occasional residential and commercial sites. The density of the access points is too low to meet statutory guidelines (Wis Statute 346.57 and 349.11) for a different rural fixed speed limit.

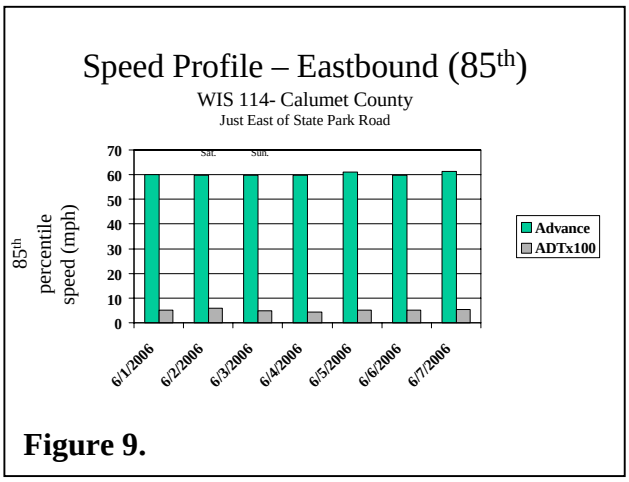


Figure 9.

Another factor taken under consideration is crash history. However, the mere presence of crashes does not in itself constitute a need for lower speed. The crashes should be speed related. Reducing the speed limit for the sake of reduction has the opposite effect in that it actually may decrease the safety of the corridor (See Solomon's Curve; Exhibit 22 in the appendix). Certain crash types indicate the need for other roadway improvements. Improvements in the pavement friction, shoulder widths, in-slopes, and back-slopes can reduce the run-off-the-road crashes, or at least the severity of crashes when vehicles are forced off the paved portion of the roadway.

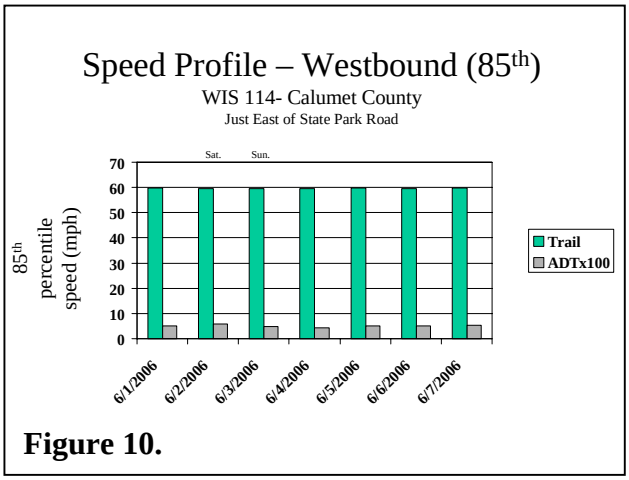


Figure 10.

The appendix to this report contains summaries of the speed data referred to in this report.

Conclusion: As a result of this engineering evaluation of WIS 114 from US 10 to Sherwood, the department does not recommend any reduction to the posted speed. WIS 114 remains an important regional arterial providing mobility between the Fox Cities and the outlying rural communities including Sherwood.

The department has taken some steps to ensure this corridor maintains its vital role as a high mobility corridor. Access was frozen per Wisconsin Statutes 84.25. This means that the current access is frozen as it was in 2002 and no new access points will be allowed. The department is also planning some improvements over the next several years. Current plans call for the construction of roundabouts at the intersections of WIS 114 at County N and at WIS 55 in 2010.

The department recognizes the rapid growth occurring in Sherwood and the town of Harrison. That growth however, requires facilities to safely move people and goods within the region. WIS 114 is one of those corridors. The future of WIS 114 should change significantly over the next 15 years as growth continues. The Wisconsin Department of Transportation is currently working with the East Central Wisconsin Regional Planning Commission on a long-term plan that will help define the necessary improvements to the highway system in this region. This study will identify future growth trends and therefore help in the creation of appropriate plans to provide facilities that safely move people and goods within the region on the state highway system. The study is scheduled to begin in 2008 with a final report in 2010.

Appendix

List of exhibits

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2. Project limit map
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8. WIS 114 Crash spot map 2001 through 2005
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